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A PUBLICATION OF THE WORLD REPORTING SERVICE ON PLANT DISEASES AND PESTS

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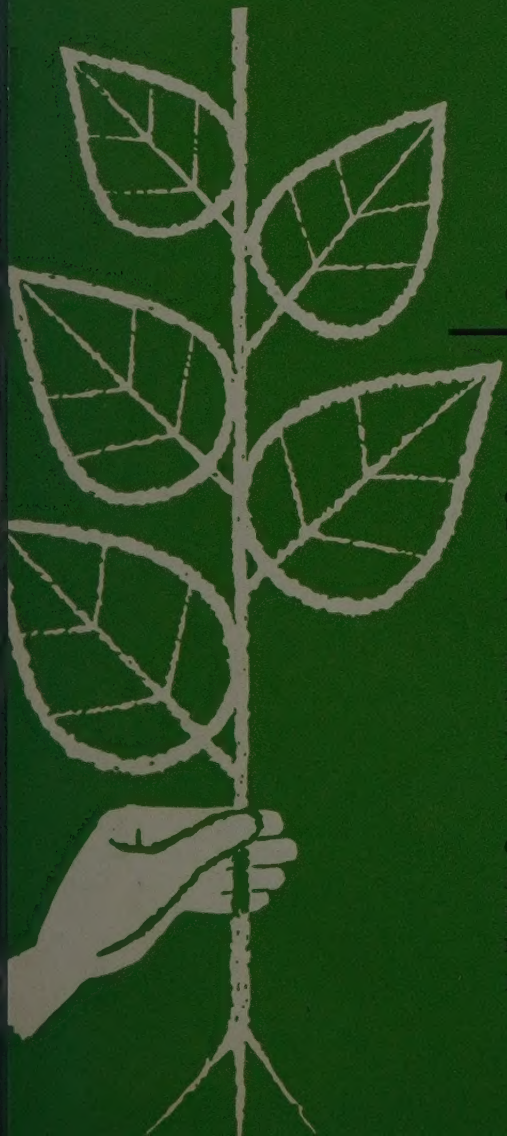

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FAO PLANT PROTECTION BULLETIN

A PUBLICATION OF THE WORLD REPORTING SERVICE ON PLANT DISEASES AND PESTS

Melcha ornatipennis: Its Occurrence in South India and a Method for its Laboratory Multiplication

V. P. Rao and S. Krishnaswamy, Commonwealth Institute of Biological Control, Indian Station, Bangalore

The parasite *Melcha ornatipennis* Cam. has aroused increased interest in recent years because of its use in the biological control of the top borer of sugar cane, *Scirpophaga nivella* F. Its efficiency in the control of the top borer was first recorded by Ahmad and Mathur (1). Gupta (7), in a reference to its introduction from North India into Pugalur in South India in 1955, mentioned that at harvest in October 1958 this parasite was found to have destroyed about 70 percent of the population of top borer. Attempts were apparently made at Pugalur to multiply the parasite in the laboratory but did not succeed. In view of the possibility of using *Melcha* for the control also of other species of *Scirpophaga*, such as *S. innotata* (Wlk.), *S. intacta* (Sn.) and *S. albinella* Cram., in countries where the parasite does not already exist, a method for its breeding in the laboratory has been developed and is described in the present paper.

Although in India *Melcha ornatipennis* has not been found to attack any of the stem borers of sugar cane, preliminary laboratory experiments made at the West Indian Station of the Commonwealth Institute of Biological Control in Trinidad, with the parasite supplied by the Indian station, have shown that it can parasitize *Diatraea saccharalis* (F.). However, in Mexico, with similar material, no parasitism of *Diatraea* spp. was observed. It seems worth while trying this parasite against other species of stem borers, including rice stem borers.

Distribution in India

Melcha ornatipennis was originally described from the Salween valley in Burma (4) and it is known to occur also in India (2).

Its occurrence in India as a parasite of *Scirpophaga nivella* was first referred to by Dutt (5) from Pusa in Bihar. Isaac (8) mentioned its occurrence at Delhi and Karnal in the Punjab. Ahmad and Mathur (1) recorded it from the Punjab, Delhi, Uttar Pradesh and Bihar in North India. Recently, Butani (3) has also referred to its widespread occurrence throughout North India. Gupta (6) recorded that 5 to 9.5 percent of the populations of the top borer in Uttar Pradesh were parasitized by this parasite between 1947 and 1949. On the other hand, Ahmad and Mathur (1) recorded that up to 45 percent parasitized borers were found in samples taken from the field.

In the belief that the parasite did not occur in South India, it was introduced from the north into the Pugalur area. However, as early as 1955, while making a general collection of parasites and predators of various insect pests, the senior writer noticed it in sugar

cane fields around Bangalore and at Mandya in Mysore State. The rate of parasitization was, however, low, being only 2 to 5 percent. A more detailed survey might show the existence of the parasite over a greater portion of Central, West and South India than has hitherto been recorded.

The success of using *Melcha ornatipennis* introduced from North India into Pugalur is possibly due to the fact that the introduced strain might be different and more efficient than those occurring in South India. Consequently, this particular strain may be of greater usefulness in the control of *Scirpophaga* spp.

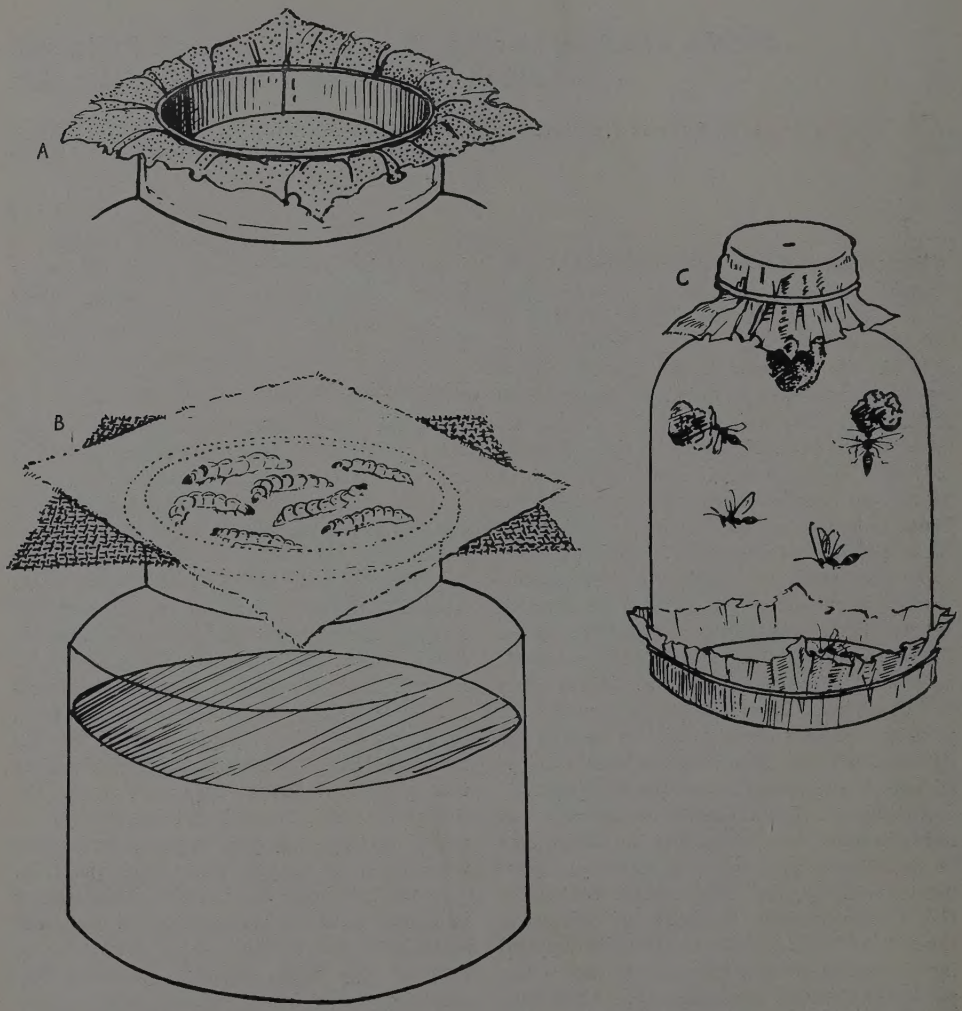

Figure 1. Diagram showing different parts of the cage used in breeding *Melcha ornatipennis*.

in other countries in Southeast Asia, where the parasite is not known to exist.

Laboratory breeding

Ahmad and Mathur (1) bred the parasite in small numbers sufficient for their studies by keeping a number of adult parasites in glass jars on Petri dishes covered with parchment, containing a layer of moist soil and pieces of sugar cane tops infested with almost fully grown larvae of the top borer.

For mass breeding the writers used the method described below. Two two-to-three-day-old male and one or two freshly emerged female parasites were placed in a jar, which resembled a bell jar but with a narrow opening at the top. Both the open ends of the jar were covered with pieces of muslin (Figure 1 A). Honey swabs were pinned to the muslin covering the top opening of the jar to provide food for the parasites. The whole jar containing the parasites was then placed over fully developed caterpillars of *Scirpophaga*

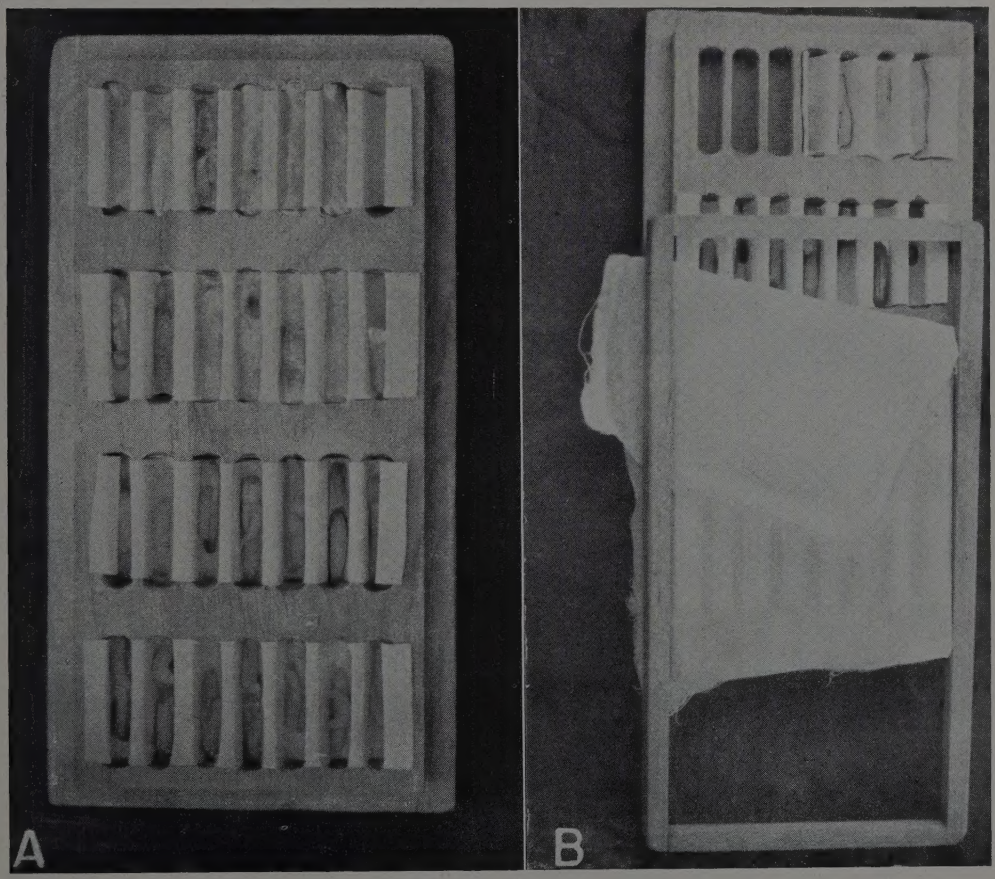

Figure 2. Breeding of *Melcha ornatipennis* Cam. A. A grooved wooden block covered with blotting paper, on which paralyzed larvae or pupae of sugar cane top borer were placed and eggs of the parasite were introduced to feed on the borer. B. A grooved wooden block with muslin cover, which is to be fixed tightly over the block by a wooden frame.

nivella, which were arranged on a piece of muslin over a wire gauze resting on a jar of water, in order to maintain high humidity (Figure 1 B). The male and female parasites copulated soon after they were placed in the jar. About 24 hours later the females were attracted by the host larvae and started paralyzing them. Eggs were then laid on or near the hosts. Sometimes the ovipositor passed through the two layers of muslin cloth and also through the wire gauze. In such cases eggs were dropped onto the third layer of muslin fixed to the mouth of the lower jar (Figure 1 C). Sometimes eggs were found adhering to the wire gauze. They were then carefully removed with a sable hairbrush once a day and placed individually over paralyzed host larvae or on unparalyzed pupae, which were put over a strip of moist blotting paper in grooves made in a wooden block (Figure 2 A). A piece of muslin cover was then fixed by a wooden frame over the wooden block (Figure 2 B). The blotting paper was moistened once a day. The wooden block was placed in a cage which had glass sides, a cloth top, and a front which could be raised. The floor of the cage was covered with a thin layer of moist sponge to provide the necessary humidity.

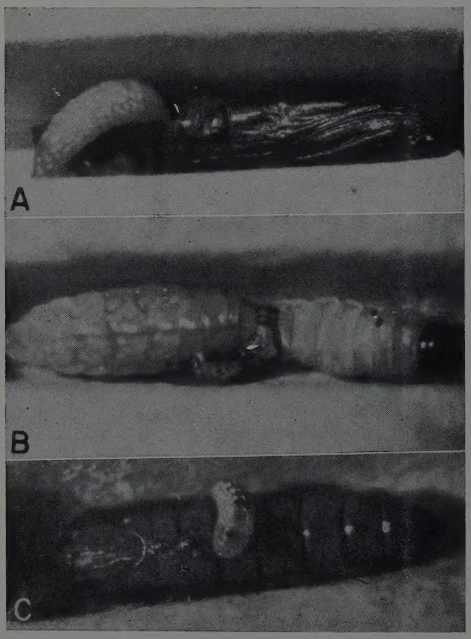

Figure 3. Feeding of the larvae of *Melcha ornatipennis* Cam. on larvae or pupae of various species of borers. A. Feeding on a pupa of *Chilotraea infuscatellus* (Sn.). B. Feeding on a larva of *Corcyra cephalonica* Staint. C. Feeding on a pupa of *C. cephalonica*.

From a single breeding jar of the type mentioned above containing two pairs of parasites, it was possible to obtain an average of 12 to 20 eggs daily. With a number of such breeding jars it would be possible to obtain large quantities of adult parasites regularly.

Adult females failed to oviposit on larvae of *Corcyra cephalonica* Staint. and *Gnorimoschema operculella* (Zell.) on stem borers of sugar cane, such as *Chilotraea infuscatellus* (Sn.) and *Proceras indicus* Kapur, or on the sorghum stem borer, *Chilo zonellus* Swinh. However, when *Melcha* eggs were placed on pupae of these species, the larvae of the parasite, on hatching, fed readily on these hosts (Figure 3). Larvae or pupae of *Corcyra* are too small to be used as host material, as they do not individually provide sufficient food for the development of a *Melcha* larva. Hence, when the parasite has consumed the body contents of one pupa, additional larvae or pupae of *Corcyra* have to be provided.

When caterpillars of alternate host species were used, it was necessary to have them paralyzed by *Microbracon hebetor* Say. or *M. brevicornis* Wesm. before the eggs of *Melcha* were transferred to them. Alternate hosts would be of great use in the multiplication and liberation of *M. ornatipennis* in large numbers. Their use would eliminate the necessity of having large numbers of top borer larvae or pupae. In the method outlined above, only a few larvae or pupae of the top borer are needed for the females of the parasite to lay eggs. Even when only a few full-grown top borers are provided, the parasites may lay large numbers of eggs on the same paralyzed hosts in about two days. Then the number of eggs dwindles. The eggs obtained may then be transferred to other hosts, as mentioned above.

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Occurrence of Bunchy Top Disease of Banana in the Philippines

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In one of the plantations in Ballesteros, Cagayan, which is a nonabaca growing area of the Philippines, banana plants of the variety Lacatan were noted on 28 May 1960 to be affected with the bunchy top disease. About 24 percent of the plants succumbed to infection.

This was apparently the first time that this malady was observed and reported on bananas in the Philippines. It was previously recorded (1) on this host from Australia, Ceylon, Fiji and other Pacific islands, Mediterranean region, India, and possibly Malaya. According to the investigations of Magee (2) in Australia, the disease is caused by a virus and can only be transmitted by the aphid *Pentalonia nigronervosa* Coq. to banana or abaca.

Ocfemia (3) noted bunchy top as a very destructive disease of abaca (*Musa textilis*) in the Philippines and its insect vector was also *Pentalonia nigronervosa.* The disease was responsible for the complete devastation of many abaca plantations in the provinces of Cavite and Laguna in 1923. However, it was not known to infect the Philippine varieties of bananas and plantains, which are close relatives of abaca (4).

The first noticeable symptom of the disease is the appearance of pale green or yellowish white areas along the margin of the youngest unrolled leaf, in contrast to the normal green color of a newly expanded leaf of a healthy plant. A closer examination of the leaf manifesting the initial symptom shows the presence of transparent membrane-like markings or lines along the secondary and main veins, especially when the leaf is held against the light (Figure 1). These transparent lines sometimes extend from the midrib to the margin of the leaf. Dark green streaks, which vary in size and shape, are also present on the lower surface of the proximal portion of the leaf blade and along the midrib and the petiole of the leaf (Figure 2).

As the disease progresses, new leaves of the infected plant unfold or open prematurely, become short, narrow and stiff, and assume an upright position with thin membranous chlorotic margins tending to curl upward. These thin membranous chlorotic leaf margins gradually turn brown and eventually wither. The growth of leaf sheaths appears to be retarded and, as a result, the petioles arise practically on the same level as the crown or at the end of the pseudostem. The leaves are bunched together or borne in a crowded manner or in a rosette-like arrangement (Figure 3).

Banana plants seriously infected with bunchy top are severely stunted in growth. The suck-

Figure 1. Top portion of a banana leaf infected with bunchy top virus, showing transparent membrane-like lines along the secondary and main veins, dark green streaks in the lamina, and chlorotic margin.

Figure 2. Upper portion of a banana plant infected with bunchy top disease. Note the presence of dark green streaks (as indicated by arrows) in the proximal portion of the leaf blade, midrib and petiole.

ers or "peepers" produced show also the characteristic symptoms of the disease.

In general, the symptoms of the disease under study resemble in all aspects the bunchy top of banana reported and described in Australia (1) and bunchy top of abaca in the Philippines (3).

In a preliminary transmission experiment, five potted young and healthy banana suckers of the variety Lacatan were inoculated by transferring to each plant 50 to 75 individuals of *Pentalonia nigronervosa* which had previously been fed for 24 to 48 hours on banana plants infected with bunchy top. To serve as a check, the same number of suckers were exposed to nonviruliferous aphids which had been colonized on a healthy banana plant.

Another transmission test was carried out, using abaca seedlings as test plant and *Pentalonia nigronervosa* as vector. Ten young, healthy seedlings were inoculated in the same way as described above, and check plants were maintained. Of the ten seedlings inoculated, six became infected, with incubation periods varying from 20 to 26 days. All the check plants remained disease-free after four to five weeks.

Further investigations to determine the relation of this disease to the abaca bunchy top, the reactions of banana and abaca varieties to the disease, as well as control measures, are now in progress.

Figure 3. A banana plant infected with the bunchy top virus in an advanced stage of the disease. Note that the leaves are short, narrow, stiff, upright and bunched at the crown, with curled margin.

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Apate monachus in Israel

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The Bostrychid beetle, *Apate monachus* (Fab.), has been described mainly in literature dealing with wood borers in Africa. Lesne (5) and Mallamaire (6,7) made some observations on its life history and habitat, but experimental studies do not seem to have been carried out. The data presented in this note are based on studies made in Israel from 1955 to 1960.

Distribution

Apate monachus is known to have originated from the tropics in Central and West Africa. From there it spread to other parts of Africa, the eastern Mediterranean and the West Indies. In its place of origin, the beetle attacks coffee and cacao, as well as many other cultivated and forest plants. In the West Indies, it also infests sugar cane, citrus, mahogany, and various tropical ornamental trees (8).

In the eastern Mediterranean, *Apate monachus* was first found in 1912 in the Syrian Region (United Arab Republic) (4). In 1930 it caused considerable damage in some citrus orchards on the coastal plain of Israel. The present outbreak in Israel began in 1950, and since then the beetle has spread to almost every part of the country, attacking various fruit trees in the coastal area as well as on the mountains.

Apate monachus as occurring in Israel, which was fully described by Bodenheimer (1), fits well with the description of the insect from Africa, as given by Lesne (5). Boselli (2) referred to the beetle found in Sardinia as *Apate monachus* Fab. var. *rufiventris* Lucas, which, according to his description, appears to differ from the species prevalent in Israel. As Boselli did not study the biology of the pest, it is not known to what extent the variety is similar to the species in behavior.

The widespread occurrence of *Apate monachus* in Israel constitutes a serious threat to some neighboring countries still free from this pest. The spread of this insect is effected mainly by the movement of timber and dried wood harboring eggs and larvae.

Habitat and damage

Apate monachus is a polyphagous insect attacking over 40 tree species in Israel. The heaviest infested fruit trees are carob, olive, grapevine, almond, peach, pomegranate, guava, citrus, pecan, apricot and fig. It was observed that in a mixed orchard the adult beetle showed food preference in accordance with the season. In the early season carob trees were mainly attacked, whereas in late August olive trees and grapevines were seriously infested.

Damage is caused only by the adult beetle, which gnaws tunnels about 10 to 20 centimeters long into the bark and wood of branches and trunks of the tree (Figure 1). Infested branches break easily in the wind or under the pressure of heavy fruit load. When the trunk

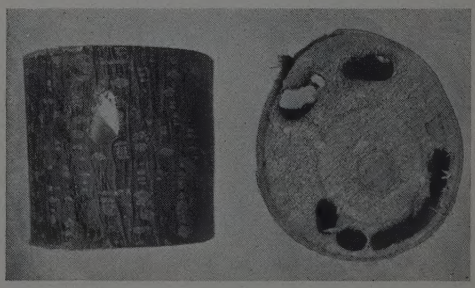

Figure 1. Tunnels made by *Apate monachus* in the stem of a tree.

or main branches are infested, normal growth of the tree is arrested and severe infestation can kill the tree.

Each beetle is capable of boring during its lifetime 7 to 8 different tunnels, which may be located on the same branch, the same tree, or various trees. About 8 to 10 days are required to complete a tunnel. In a severely infested tree, 300 to 500 tunnels may be found with 50 to 70 live beetles.

On an olive tree, most of the bore holes are found in the upper branches, although many such holes are also in the main branches and the trunk. Usually the beetles begin to bore holes on the lower part of the tree and gradually move upward. Two, three or four beetles may be found in one tunnel which serves as a shelter during the day and in which copulation takes place.

Figure 2. Eggs of *Apate monachus* in crevices of dried wood.

Figure 3. A larva of *Apate monachus* inside the tunnel.

Life history

Beetles usually begin to appear in May or, in the cooler mountain areas, in April. The highest adult population is found in orchards during July and August. The last beetles are observed in November. As soon as they appear on the trees they start to bore tunnels and normally copulate in the first bore hole to be formed. As nocturnal insects, the beetles are found during the day only inside the bore holes. From evening to early morning, they move on the trees or fly slowly and oviposit in the crevices of dried branches (Figure 2) or dried cut wood, but never on living trees. Eggs may be also laid on timber or wood which is not too old or too dry.

Female beetles oviposit throughout their lifetime ; therefore, eggs can be found from the end of May to the beginning of December. The

average number of eggs produced by one female was found to be 77, the maximum 125. Eggs hatch in 5 to 6 days during the summer and in 8 to 9 days during autumn. After hatching, larvae start gnawing immediately into the bark of the dead parts of the tree, and then penetrate into the wood and bore longitudinally into the branches (Figure 3). The development of larvae requires 30 to 35 months, during which period the larvae remain in the same branch. Throughout this time, larvae were found to gnaw actively without dormancy or diapause. In the field, the larval stages of different generations may overlap, so that in the winter of 1960 larvae hatched in the two previous years were found in some dead branches.

Larvae pupate in tunnels in the dead branch after April (Figure 4) and pupae are found during the spring, summer and early autumn. In the spring, the pupal stage lasts from 15 to 18 days. Newly emerged beetles must gnaw their way out through the dead wood; this process takes 5 to 15 days.

Table 1 shows the seasonal development of *Apate monachus* as observed in six tests in gauze cages under field conditions. During these tests, mortality of larvae was observed and found to be highest (22 percent) during July, August and October and lowest (1-4 per-

Figure 4. Pupa of *Apate monachus*.

Table 1. — Seasonal development of *Apate monachus* under cage in Israel

Test	Date of				
	oviposition	hatching egg	pupation	beetle emergence	beetle appearance in field
	1957	1957	1960	1960	1960
1	17 May	23 May	2 April	15 April	24 April
2	4 June	10 June	25 April	10 May	24 May
3	9 June	14 June	10 May	3 May	15 June
4	10 July	16 July	12 June	30 June	12 July
5	12 October	23 October	2 April	19 April	30 April
6	22 November	30 November	28 June	13 July	24 July

cent) from January to March. Parasites or predators were not noticed.

A higher rate of natural mortality was observed in pupae: 40 percent in May, 27 percent in June, 23 percent in August, 13 percent in October and 22 percent in November. Egg mortality was about 5 to 13 percent, being highest in August.

The influence of temperature on the activity of beetles was studied in the laboratory. It was found that adults became active at about 10° C. and died at 53° C. The optimum temperature appeared to be at 20° to 35° C., the beetles becoming restless at 45° C.

Natural enemy

Only one predator, *Leucospis dorsigera*, was found to be a natural enemy of *Apate monachus* in Israel. This wasp lays its eggs on dried branches in the vicinity of the tunnel produced by the larva of *A. monachus*. After hatching, the larva of the wasp moves toward the larva of *A. monachus* and preys upon it. On several occasions, as many as 4 larvae of the predator were found on 1 larva of *A. monachus*. In the winter of 1958, on 500 larvae collected in the field, only 18 of the wasp were found. The larvae of the wasp were never observed in late spring, summer or autumn.

Chevalier and Dufrenoy (3) found that in Africa adult beetles of *Apate monachus* on coffee trees were attacked by pathogenic fungi, but in Israel no parasites at all were found on the thousands of beetles examined.

Control measures

Field sanitation measures, such as burning dead branches, eradication of dead trees, pruning, etc., are recommended for reducing the infestation of *Apate monachus*, but such measures cannot be practiced everywhere. Treatment of bore holes with a fumigant, or ferreting out the insect with a wire are impracticable, and such measures can only be supplementary to other control measures. The use of parasites or predators introduced from the original habitat of the beetle may provide a solution, but this requires further investigation.

In Israel, laboratory and field experiments with insecticides have shown that the beetle is most susceptible to BHC and dieldrin. From 10 June to 30 August 1959, the application of 20 percent BHC dust in seven treatments at 15-day intervals prevented the penetration of beetles into carob trees and grapevines in heavily infested areas. In 1960, similarly good results were obtained with three treatments at intervals of one month, applied from 1 July to 1 September. In both cases, it was found that the treatment of only the trunk and lower parts of the branches was sufficient to prevent damage.

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Recommended Analytical Methods for Pesticides

2. DETERMINATION OF SULPHUR IN COLLOIDAL SULPHUR[1]

Collaborative Pesticides Analytical Committee,
c/o Plant Pathology Laboratory, Harpenden, Herts, England

Principle. Sodium sulphite and ammoniacal zinc chloride solutions are added to the samples; the sulphur present is converted into thiosulphate; excess sodium sulphite is removed by precipitation with strontium chloride; excess ammonia is removed by treatment with tartaric acid and the thiosulphate titrated with 0.05N iodine solution. A correction is made for any thiosulphate present in the original samples.

Reagents

Ammoniacal zinc chloride - dissolve zinc chloride (50 gm) in distilled water (500 ml.), add ammonia solution (125 ml. sp. gr. about 0.880), and ammonium chloride (50 gm.) and dilute to 1 liter with distilled water.

Sodium sulphite - dissolve sodium sulphite (25 gm. $Na_2SO_3 . 7H_2O$) in water and make up to 250 ml. Use only the freshly prepared solution.

Strontium chloride - Dissolve strontium chloride (100 gm.$SrCl_2 . 6H_2O$) in water and make up to 1 liter. Tartaric acid - freshly prepared 10 percent solution.

Iodine - 0.05N, standardized against arsenous oxide dried at 105° C.

Methyl red - 0.2 percent indicator solution in 95 percent ethanol.

Starch - indicator solution.

Apparatus

50 ml. weighing bottle - tared
Two 250 ml. volumetric flasks
1,000 ml. volumetric flask
350 ml. conical flask
250 ml. conical flask
Filter funnel and filter paper
Steam bath
Wash bottle of distilled water
Wash bottle of boiling distilled water
50 ml. burette
10 ml. measuring cylinder
Two 50 ml. measuring cylinders
25 ml. pipette
50 ml. pipette

Sampling. A representative sample should be taken which should be not less than 100 gm. Particular care is necessary in preparing a sample of colloidal sulphur for analysis, as these products are suspensions.

Method

(i) *Stock solution.* Mix the sample thoroughly either by stirring or by shaking until the contents are uniform. Immediately transfer about 10 ml. of the sample to the tared weighing bottle (x gm.), weigh as quickly as possible (w gm.), and transfer quantitatively to the liter volumetric flask. Make up to the mark with distilled water (recently boiled and cooled).

(ii) *Determination of sulphur.* From the stock solution, pipette immediately after mixing well 25 ml. into a 350 ml. conical flask already containing ammoniacal zinc chloride solution (10 ml.) and sodium sulphite solution (35 ml.).

[1]This method was accepted in June 1960 by the Collaborative Pesticides Analytical Committee (CPAC), which consists of scientists from seven European countries having a substantial chemical industry. The secretary of the committee is Dr. R. de B. Ashworth, Plant Pathology Laboratory, Hatching Green, Harpenden, Hertfordshire, United Kingdom.

Place the flask on a steam bath at full heat for at least 45 minutes, shaking the flask and washing down the inside with boiling water from a wash bottle at about 10 minute intervals. Remove the flask from the steam bath, add strontium chloride solution (30 ml.), allow to stand for 5 minutes, and transfer to a 250 ml. volumetric flask. Cool, make up to the mark with water and shake. Filter through a filter paper of diameter not greater than 12.5 cm., rejecting the first portion of the filtrate until clear. To a 50 ml. aliquot of the clear filtrate add methyl red solution (one drop), and make the solution slightly acid with the tartaric acid solution. Titrate the thiosulphate present with the iodine solution (t ml.), using starch solution as indicator.

The figure obtained for the colloidal sulphur must be corrected for the thiosulphate content originally present as follows:

From the well-mixed stock solution pipette 25 ml. into a 250 ml. volumetric flask already containing ammoniacal zinc chloride solution (10 ml.) and distilled water (about 20 ml.). Make up to the mark with distilled water (recently boiled and cooled), shake thoroughly, and filter through a dry filter paper, rejecting the first portion of the filtrate until clear. To a 50 ml. aliquot of the filtrate, add methyl red solution (one drop), and make the solution slightly acid with the tartaric acid solution. Titrate with the iodine solution (s ml.), using starch solution as indicator.

1 ml. 0.05N iodine solution = 0.0016 gm. of sulphur.

$$\text{Percentage sulphur, w/w} = \frac{32\,(t - s)}{w \text{ - } x} \text{ (Note 1)}$$

Note 1. The figure $(t - s)$ should be less than 35 ml. (i.e., the amount of sodium sulphite solution added), thereby indicating that an excess of sodium sulphite has been used.

Recommended Analytical Methods for Pesticides

3. DETERMINATION OF SULPHUR IN DISPERSIBLE SULPHUR[1]

Collaborative Pesticides Analytical Committee,
c/o Plant Pathology Laboratory, Harpenden, Herts, England

Reagents

As for CPAC method No. 2

Apparatus

50 ml. weighing bottle - tared
250 ml. volumetric flask
350 ml. conical flask
250 ml. conical flask
Filter funnel and filter paper - not larger than 12.5 cm. in diameter
Steam bath
Wash bottle of distilled water
Wash bottle of boiling distilled water
50 ml. burette
10 ml. measuring cylinder
50 ml. measuring cylinder
25 ml. pipette
50 ml. pipette

Method. Weigh accurately about 0.2 to 0.3 gm. (z gm.) of the material, and transfer it quantitatively to ammoniacal zinc chloride solution (10 ml.) sodium sulphite solution (35 ml.) contained in the 350 ml. conical flask, using distilled water (25 ml. recently boiled and cooled).

Place the flask on a steam bath at full heat for at least 45 minutes, shaking the flask and washing down the inside with boiling water from a wash bottle at about 10 minute intervals. Remove the flask from the steam bath, add strontium chloride solution (30 ml.), allow to stand for 5 minutes and transfer to a 250 ml. volumetric flask. Cool, make up to the mark with water and shake. Filter through a filter paper of diameter not greater than 12.5 cm., rejecting the first portion of the filtrate until clear. To a 50 ml. aliquot of the clear filtrate add methyl red solution (one drop), and make the solution slightly acid with the tartaric acid solution. Titrate the thiosulphate present with the iodine solution (t ml.), using starch solution as indicator (Note 1).

$$\text{Percentage sulphur, w/w} = \frac{0.8\,t}{z}$$

NOTE 1. In the case of dispersible sulphur, it is not usually necessary to apply a correction for thiosulphate present in the original sample.

[1]This method was accepted in June 1960 by the Collaborative Pesticides Analytical Committee (CPAC).

Recommended Analytical Methods for Pesticides

4. DETERMINATION OF PARTICLE SIZE DISTRIBUTION IN COLLOIDAL AND DISPERSIBLE SULPHURS[1]

Collaborative Pesticides Analytical Committee,
c/o Plant Pathology Laboratory, Harpenden, Herts, England

Principle. A portion of the sample is weighed; mixed with water to give a suspension which is poured into a sedimentation tube.

For particles of 6 μ or less the amount of sulphur in the top 20 cm. of the tube is determined after 166 minutes. For particles of less than 2 μ the sulphur determination is made after 27 hours.

Reagents

As for CPAC method No. 2

Apparatus

As for CPAC method No. 2, together with
100-ml. tapered cylinder with a cone-shaped bottom (Note 1)
Stout glass rod with rounded end to fit bottom of receiver
Graduated sedimentation tube (see Figure 1)

Sampling. A representative sample should be taken which should be not less than 100 gm. Particular care is necessary in preparing a sample of colloidal sulphur for analysis, as these products are suspensions.

Method. Mix the sample thoroughly, weigh accurately about 10 gm. and transfer to the tapered cylinder. Stir with a stout glass rod with a rounded end (the rod must fit the bottom of the cylinder) and add distilled water very gradually. Continue to stir the material with water to break up aggregated particles. A uniform technique gives reproducible results.

Transfer to the liter volumetric flask and make up to the mark with distilled water, which should be brought to the temperature at which the test is being carried out. Shake

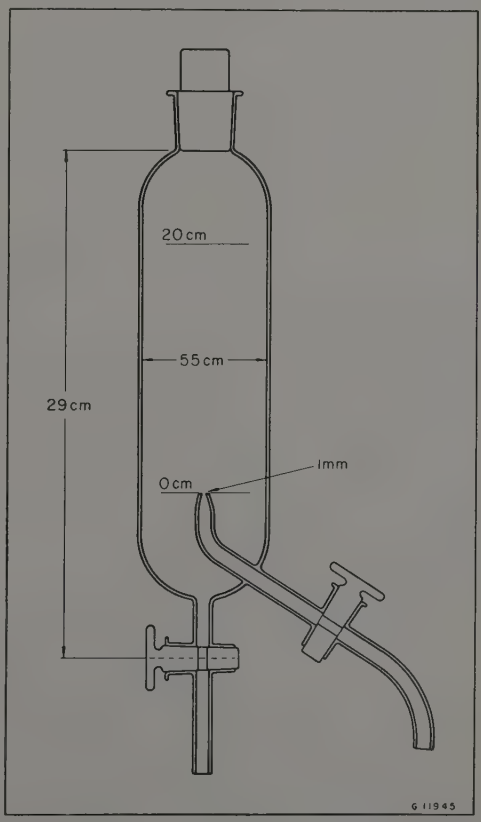

Figure 1. Graduated sedimentation tube.

[1]This method was accepted in June 1960 by the Collaborative Pesticides Analytical Committee (CPAC).

the contents of the flask thoroughly and pour into the sedimentation tube up to the 20 cm. mark (Note 2).

Allow the sedimentation tube to stand at 22° to 25° C., avoiding excessive vibration for 166 minutes (Note 3). Remove the whole of the suspension above the run-off, mix thoroughly and determine the sulphur in the suspension by CPAC No. 2, *Method* (ii) *Determination of sulphur*.

Repeat the whole procedure, allowing the sedimentation tube to stand for 27 hours (Note 3), and determine the sulphur present as before.

The values obtained for the sulphur content of the suspension should be expressed as percentages of the sulphur present in the original sample. These percentages are the quantities of particles of 6 μ or less and 2 μ or less respectively present in the material.

NOTE 1. A cut-down 100-ml. Crow receiver is suitable.

NOTE 2. In the case of products in which some particles settle very rapidly, determine the capacity of the sedimentation tube to the 20-cm. mark; prepare the suspension as before in the open cylinder. Transfer the suspension direct to the sedimentation tube and add distilled water to the 20-cm. mark.

NOTE 3. The relationship between particle size and time of settling is given by the British Coal Utilisation Research Association settling formula, viz:

$$d = 175 \sqrt{\frac{n}{S-s}} \times \sqrt{\frac{h}{t}}$$

where n = viscosity of fluid = 0.01 at 21° C.
S = specific gravity of solid = 2.07 for sulphur
s = specific gravity of water = 1
h = height of settling in cm.
t = time in minutes
d = diameter of largest particles in μ

OUTBREAKS AND NEW RECORDS

JAMAICA

Gerald Stell, Plant Protection Division, Ministry of Agriculture and Lands, Kingston

First record of tristeza

The presence of tristeza virus was suspected by Dr. W. C. Price, Virologist, Citrus Experiment Station, Lake Alfred, Florida, on a visit to Jamaica in June 1960, from symptoms exhibited in grapefruit and sweet orange trees budded onto sour orange rootstock. These symptoms consisted of severe tree stunting and extensive honeycombing of the inner side of the bark immediately below the bud union.

Transmission tests have subsequently shown vein flecking in seedlings of West Indian lime (*Citrus aurantifolia*) when grafted with infected bud material, which has been confirmed by Dr. Price as diagnostic of the disease.

The behavior of tristeza in Jamaica resembles the mild strain found in Florida, from where presumably it must have originated in the original citrus plant importations.

The incidence of the disease in Jamaica is very low and it is not being disseminated by insect vectors to any appreciable extent, if at all. This may be due to the fact that the only known vector recorded in Jamaica is *Aphis gossypii* Glover, which is of low efficiency in disseminating the causal virus.

Strict enforcement of quarantine measures to prevent the importation of a more virulent form of the disease and entry of the efficient insect vector, *Toxoptera* (*Aphis*) *citricidus* (Kirkaldy), is being maintained at all ports of entry. New sources of clean bud material are being selected, and susceptible rootstocks disc arded and replaced by resistant or tolerant ones.

NICARAGUA

George H. Berg, Expanded Technical Assistance Program, FAO, Managua

Discovery of *Sogata orizicola*, the vector of hoja blanca

At the present time, Nicaragua is considered as a country where the hoja blanca disease of rice has been reported but not verified. Neither has the vector *Sogata orizicola* Muir been identified from among the many insect specimens previously collected from rice plants and grasses, nor are there specimens of this species in Nicaragua's National Collection of economically important insects. Only specimens identified as *Sogata* spp. have been collected in the past.

On 13 February 1961, Mr. Francisco A. Estrada R., Chief of the Sección Nacional Antiacridia in the Nicaraguan Ministry of Agriculture, submitted several vials of homopterous insects collected during the previous week to the writer for identification, after noting several specimens that resembled *Sogata* spp. All specimens submitted were collected from rice plants of a hoja blanca resistant variety on Finca Triunfo, located in the Jurisdiction of Tipitapa, approximately 35 kilometers from Managua. An examination of these specimens revealed the presence of four specimens which were identified by the writer as *Sogata orizicola*. The identification was subsequently verified by Mr. J. P. Kramer of the Insect Identification and Parasite Introduction Branch, Agricultural Research Service, United States Department of Agriculture. As a result of this finding, Nicaragua can now be grouped with Puerto Rico, British Guiana, Argentina and Mexico as territories where the vector, but not the disease, has been identified.

During 1960, on the same plantation, it was reported that a very low yield was secured from the rice crop cultivated on 1,000 manzanas (1,742 acres), due to insect damage and the presence of a number of rice diseases,

Piricularia oryzae Cav. and hoja blanca having been reported as the two predominant diseases. Consequently, during 1961, a hoja blanca resistant variety of rice, Nilo 13, was planted on 180 manzanas under irrigation. This variety was originally introduced from Louisiana under the number RR251 of 1958, and is derived from the cross of Rexoro with red rice. As a result of the planting of this resistant variety, coupled with carefully timed insecticidal treatments principally intended to control the fall armyworm, *Laphygma frugiperda* (Smith & Abbott), and homopterous insects, a fine crop of rice unaffected by the hoja blanca disease and with a minimum of insect damage was harvested during the latter part of March and April 1961. During harvesting time, it was estimated that the current rice crop would yield about 45 quintals per manzana (about 2,586 lb. per acre), a striking contrast to the yield in November 1960, when only approximately 8 to 10 quintals per manzana (about 459 to 574 lb. per acre) were harvested on the same plantation.

PAKISTAN

M. A. Ghani, Commonwealth Institute of Biological Control, Pakistan Station, Rawalpindi

European corn borer in West Pakistan

The European corn borer, *Pyrausta nubilalis* (Hb.), is widely distributed over the greater parts of Europe, Asia and North America. However, there has been only one published reference [1] to this insect in West Pakistan, which was based on the specimen in the British Museum (Natural History) collected from West Punjab in 1909. On enquiry, Mr. E.O. Pearson, Director of the Commonwealth Institute of Entomology, indicated that although there are Indian collections in the British Museum from Dharamsala, Bengal, Nagrispur, Kangra Valley, Kharis Hills, Shillong and Assam, the collection indicated above is the only one from Pakistan.

While examining some weeds in the Murree Hills in June 1959, heavy infestations of the larvae of the European corn borer were observed on *Cnicus wallichii* DC., a thistle found abundantly on the hills above 4,000 feet. Stems and branches were completely riddled by the larvae, very often 30 to 40 of which could be collected from a single plant. The young larvae usually entered the plant through axils of leaves and branches. Overwintering took place as full-grown, and only rarely as half-grown larvae, in semidried and dried plants. The rate of parasitization was extremely low and only once was one parasitic hymenopterous grub found in a sample of more than 625 larvae.

In 1960, the European corn borer was again recorded from the same weed at Chikar (Kashmir) and Skardu (Gilgit Agency). The insect probably has a much wider distribution in the northern and northeastern regions of West Pakistan and is likely to be found wherever this weed occurs.

The European corn borer has not as yet been observed on any plant other than *Cnicus wallichii*. Although throughout the Murree Hills maize grew side by side with the weed harboring huge populations of the larvae of the borer, the insect was never found on maize. A similar phenomenon was observed by Parpova [2] in the Bryansk region of the U.S.S.R., where the pest occurred abundantly on hemp, millet and weeds, while maize was not attacked. A certain degree of specialization in food plants was observed in the borer and Parpova concluded that adaptation of the hemp population of the corn borer to maize was possible.

In view of these observations and the fact that the corn borer is prevalent in the hilly maize-growing tracts in the north and northeastern regions of West Pakistan, it probably constitutes a potential threat to the maize crop in these areas, particularly if at any time its present host, *Cnicus wallichii*, is eliminated.

[1] Commonwealth Institute of Entomology. 1951. Distribution Maps of Insect Pests. Series A, Map No. 11. *Pyrausta nubilalis* (Hb.).

[2] Parpova, A.I. 1959. Development and food relationships of the European corn borer *Pyrausta nubilalis* Hb. (Lepidoptera, Pyralidae) in new regions of maize cultivation. (In Russian) *Entomological Review* 38 : 651-658.

PLANT QUARANTINE ANNOUNCEMENTS

BELGIUM

Royal Decree of 10 November 1960, published in the *Moniteur belge* Vol. 130, No. 282 of 24 November 1960, provides measures for preventing the introduction and spread of potato wart (*Synchytrium endobioticum*) and potato bacterial diseases (*Corynebacterium sepedonicum* and *Pseudomonas solanacearum*).

The importation of potatoes is authorized only if the consignment is accompanied by a certificate issued by the Plant Protection Service of the country of origin, attesting that it is free from harmful pests and diseases. For potatoes for consumption or fodder use, the certificate must, in addition, declare in French or Dutch that the consignment is free from potato wart and potato bacterial diseases. For seed potatoes, the certificate must declare in French or Dutch that the consignment is free from the above-mentioned diseases and that the potatoes were grown in a region where these three diseases do not occur. Any consignment is subject to inspection on arrival.

A Ministerial Decree of 12 November 1960, published in the same issue of the *Moniteur belge*, authorizes the following custom offices through which potatoes may be imported.

By sea or waterways: Antwerp, Brussels, Ghent, Heer-Agimont (Meuse), Blélıaries (station), Ostend, Zeebrugge (Bruges).

By rail: all points open for importation by rail.

By road: Strobrugge (Maldegem), Zelzate (station), Paal (Kemzeke), Essen (village), Poppel, Kessenich, Veldwezelt, Mouland, Hauset, Deyfeld (Beho), Longvilly, Rosenberg (Autelbas), Aubange, Beaubru (Bouillon), Heer-Agimont (Meuse), Quiévrain (village), Blélıaries (station), Risquons-Tout (Mouscron), Abele (Poperinge).

By air: Antwerp (Deurne), Brussels (Melsbroeck).

MAURITIUS

Proclamation No. 17 of 8 August 1959, published in the *Legal Supplement to the Government Gazette of the Colony of Mauritius* No. 46 of 14 August 1959, regulates the importation of plants into Mauritius and its dependencies. This proclamation revokes Proclamations No. 1 of 15 January 1949, No. 12 of 2 September 1949, No. 8 of 22 March 1950, No. 19 of 31 October 1950, No. 22 of 14 August 1953, No. 14 of 30 July 1955, No. 6 of 17 April 1956, No. 11 of 22 August 1958 and No. 10 of 30 April 1959.

Imports prohibited

1. Sugar canes or cuttings or any part of the sugar cane plant.
2. Earth, leaf or garden mold, compost and farmyard manure.
3. Any live plants and parts thereof (including roots, tubers, cuttings, grafts and buds) in any kind of soil.
4. Dung or animal droppings (except guano and dung or animal droppings from Rodrigues).
5. Green and dried grass, legumes and any other plant material used as forage.
6. Timber with bark.
7. All species of *Opuntia*.
8. All species of *Camellia*, except live plants, parts thereof and seeds of *Camellia sinensis* from Africa South of the Sahara.

Imports prohibited from certain areas

1. Live grapevine plants and parts thereof from Japan, China (including Manchuria) and Korea.
2. Any live plants and any parts thereof (including fresh fruit, but excluding seeds of the family Rosaceae) from Southeast and

East Asia (north of the equator and east of 60° longitude) and the Pacific Islands. Apple for consumption is not subject to this prohibition.

3. Live dahlia plants and parts thereof (except seed) from South Africa and the Federation of Rhodesia and Nyasaland.
4. Potatoes from the United States, Canada and France.
5. Maize from the United States, Canada, Mexico, Puerto Rico, Italy and any other country where Stewart's disease of maize occurs.
6. Live sunflower (*Helianthus annuus*) plants and parts thereof (including seed) from all countries of South America south of Panama.
7. Any live plants and any parts thereof (including fresh fruits, roots, tubers, vegetables and cut flowers, but excluding seed) from Madagascar, except when they are accompanied by a certificate signed by a representative of the Chamber of Commerce of Tamatave or by an officer authorized by *the Section de défense des cultures et du contrôle phytosanitaire de Madagascar* to the effect that they have been fumigated at the *Station de désinfection de Tamatave*.

Imports requiring permit

The following articles may be imported only under a permit obtained previously from the Director of Agriculture and under restrictions specified in the permit.

1. Dung or animal droppings from Rodrigues.
2. Live plants, parts thereof and seed of *Camellia sinensis* from Africa South of the Sahara.
3. Fresh apples for consumption from South-east and East Asia.
4. Sphagnum moss and peat.
5. Mushroom spawn.
6. Any live plants and parts thereof (including fresh fruits, roots, tubers, vegetables, cut flowers and seed for planting, but excluding seed of ornamental plants, shrubs and trees ; fresh fruits and vegetables from Rodrigues ; and seeds for consumption) when imported by sea or air.
7. Sand, ballast imported into Mauritius from any country including the dependencies of Mauritius. Such imports are subject to conditions imposed by the Director of Agriculture for unloading, packing, removal and treatment before use.
8. Any articles imported by the Government for scientific investigations.

Inspection

The following articles, importation of which is either prohibited or requires permit, are subject to inspection.

1. Any live plants and parts thereof (including roots, tubers, vegetables, cuttings, grafts and buds).
2. Any seed, cut flowers and fresh fruits.
3. Sphagnum moss and peat.
4. Dung or animal droppings from Rodrigues.
5. Any kind of timber, except packing cases.

Packing material

Wrappings, cases, packages or any packing material from any place including the dependencies of Mauritius may be ordered to be destroyed if found or suspected not to be free from plant pests and diseases.

SPAIN

Order of 7 December 1960, published in the *Boletín Oficial* Vol. 25, No. 312 of 29 December 1960, prohibits the importation of banana plants into the Canary Islands in order to prevent the introduction of Sigatoka disease (*Mycosphaerella musicola*).

Importation of living or dead banana plants or parts thereof into the Canary Islands from any country is prohibited. Only the Subtropical Crop Station in Málaga is authorized to import banana plants for experimental or breeding purposes. A special permit from the General Direction of Agriculture is required for any subsequent introduction into the Canary Islands.

The customs and free-port authorities in the Canary Islands are not empowered to deal with consignments containing banana plants or parts thereof. They must advise the competent agricultural authority, who will burn the material immediately.

VENEZUELA

Two Resolutions of 12 December 1960, issued by the Ministry of Agriculture and Animal Husbandry and published in the *Gaceta Oficial*, Vol. 89, No. 26432 on 14 December 1960, concern the importation of plant materials. Resolution AG-378 establishes rules regarding the inspection of imported plant materials at the points of entry. Resolution AG-379 prohibits the importation of any kind of citrus plants and their fruits, cuttings and buds. Such materials may be imported only by the Ministry of Agriculture and Animal Husbandry for experimental purposes.

NEWS AND NOTES

EUROPEAN COMMITTEE FOR CO-OPERATION IN FRUIT TREE VIRUS RESEARCH

The European Committee for Co-operation in Fruit Tree Virus Research, during the Fourth Symposium on Virus Diseases of Fruit Trees in Europe, held in Lyngby, Denmark, 25-30 July 1960, presented a suggested revised list of indicators for fruit tree viruses. This list, with some modifications, has now been accepted by all the participants of the symposium. In addition to indicator varieties recommended for the identification of many viruses affecting apple, pear, cherry, plum, peach and apricot, the list also includes the names and addresses of institutions from which indicator materials in small quantities may be obtained. The list, entitled "A revised standard minimum range of indicator varieties for fruit tree viruses in Europe," is obtainable from Dr. H. Rønde Kristensen, Statens Plantepatologiske Forsøg, Lyngby, Denmark.

INTERNATIONAL NEMATOLOGY SYMPOSIUM

The Sixth International Nematology Symposium convened by the European Society of Nematologists will take place in Gent, Belgium, 25-28 July 1961. The preliminary program circulated includes lectures on root-knot nematodes, cyst-forming nematodes and free-living nematodes, as well as on techniques, systematics, ecology, and related subjects. Excursions to visit agricultural institutions and field trials will be organized during the symposium. Further enquiries should be addressed to the Secretary of the Symposium, c/o Rijkslandbouwhoogeschool, Coupure Links 233, Gent, Belgium.

INTERNATIONAL MEETINGS ON COFFEE AND BANANA

The First FAO Meeting on Coffee Production and Protection and the First FAO/CCTA Meeting on Banana Production were held at Abidjan, Ivory Coast, 12-19 and 21-29 October 1960, respectively. Both meetings covered pest and disease problems.

At the coffee meeting, the work on the biological specialization of coffee rust and the testing of coffee seedlings for rust resistance, carried out by the Coffee Rust Research Laboratory at Oeiras, Portugal, was reported. The need for expanding this international work was stressed. It was also reported that a Rust Research Group was recently established in Kenya, where an integrated research program is being carried out on coffee rust, with special emphasis on breeding for resistance. In Kenya, some hybrids have shown remarkable hybrid vigor, producing under rather unfavorable conditions 1 ton of clean coffee per acre in their fourth year.

In Angola, "sudden death" disease of robusta coffee was reported to have destroyed in recent years 3 million coffee trees annually, amounting to a loss of more than 1 million U.S. dollars. The cause of the disease is still unknown. A similar disease causing die-back on arabica coffee in Nyasaland was reported to be caused by a species of *Fusarium*, which could be transmitted readily by pruning knives and also by *Antestiopsis*.

Among insects affecting coffee, the coffee branch borer, *Xyleborus morsatti*, was reported to be the most damaging one in Ghana, and *Antestiopsis lineaticollis* the most injurious in British East Africa.

At the banana meeting, it was reported that in New Zealand a pretreatment of planting

material with a mixture of dieldrin and oils gave effective control of mealy bugs. The nematode *Radopholus similis* was stated to be widespread and was responsible for 90 to 95 percent losses caused by nematodes.

Among diseases affecting bananas, Panama disease and Sigatoka were discussed at length. A new method used by the United Fruit Co. for obtaining sound planting material free from Panama disease was described. Corms and suckers are to be collected from apparently healthy mats, kept for ten minutes in hot water (131° F.), placed in individual containers filled with sterilized soil, and then planted in disease-free areas. A disease known as "false mosaic," which causes black spots on leaves and premature defoliation, was reported from the African coast.

IMPROVEMENT IN OLIVE CULTIVATION

FAO Agricultural Studies No. 50

A New Study

Recognizing that the economic sources of olive plantations must depend entirely on the improvement of cultural practices, this publication, while reviewing existing knowledge on olive production, attempts to illustrate ways and means of achieving such improvement. Results of research and experiments conducted by many experts in olive growing have been drawn on extensively in compiling the work.

Chapters are devoted to general characteristics of the olive tree, its varieties and cultural requirements, while others relate to improvements in production, propagation, and the establishment of an olive grove. Manures and fertilizers, as well as pruning, are dealt with in separate sections of the publication. Other topics include irrigation, harvesting and yield, control of pests, diseases, and other hazards of olive growing.

The study contains numerous appendixes and an exhaustive bibliography. Illustrations include 80 photographs and designs.

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